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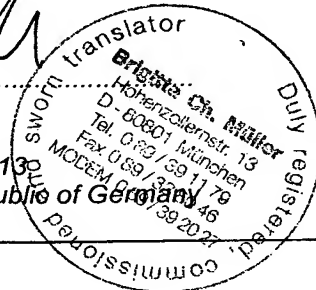
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Munich I Regional Court Reg. No. UE 131/91

Munich, 16 January 2007

(Sworn translator's signature and seal)

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## RETROFIT KIT FOR A TRAINING DEVICE AND TRAINING DEVICE

The invention relates to a training device and a retrofit kit for a training device, whereby the training device is adapted to be operated by a training force applied by an individual who is training and by means of a training weight, which can be formed by one or more combinable single weights, a counterforce to oppose the training force, whereby the retrofit kit comprises an oscillation generating device which is adapted to be fitted to the training device and to produce an oscillation which influences and modulates the counterforce.

Training devices of this kind are used within the framework of weight training to train certain muscles or groups of muscles in that a body part is moved under the application of the training force against the resistance of the counterforce.

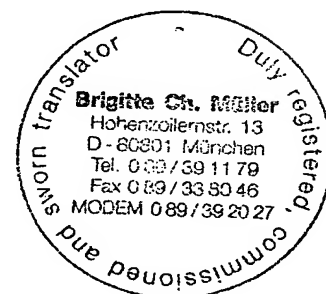
The weight training can be carried out with unrestricted movability of the body part as with free weight training, for example with dumbbells. Free weight training however requires a certain amount of training experience and a good feeling for movement, because the movement of the body part must be performed so exactly that essentially only the muscles to be trained are used to overcome the counterforce. If the movement is performed incorrectly or inaccurately, then the risk of injury increases on one hand and the efficiency of the dumbbell training is reduced on the other.

In order that individuals who have little sports experience can perform weight training, mechanically more complex constructions are used instead of dumbbells as the training device. The objective of these training devices is to guide the training movement exactly and to facilitate a simple and precise setting of the counterforce, so that a predetermined selection of muscle groups is trained exclusively.

The design of these training devices differs on one hand in the type of muscle groups involved. For example, for a training of the extensor muscles pressure plates or handles are provided as actuating elements which are pushed away from the body against the counterforce. For a training of the flexor muscles actuating elements are provided which must be pulled towards the body against the counterforce.

The configuration of the actuating element in turn depends on the body part to be trained. For example, handles are provided for training the arm and shoulder muscles. In contrast, for training the trunk and leg muscles usually upholstered pressure elements, plates or loops are provided.

On the other hand conventional training devices differ depending on the way in which the counterforce is produced. In principle the training force can be produced by a force generating device mechanically, kinematically, electromagnetically or pneumatically. Most common is the generation of the counterforce in a



mechanical way by a training weight. In a kinematic manner the training force can be produced by a frictional or motion resistance, for example by a rotor turning in a liquid or by an eddy-current brake. In an electromagnetic manner the counterforce can be generated by the magnetic attractive force or by a generator. Also a pneumatic generation of the counterforce by pressure cylinders is possible. All these devices permit an exact setting of the counterforce, for example, by changing the training weight or by changing the pressure in the pressure cylinder.

Some training devices exhibit complex controls and enable a limitation of the speed with which the training movement can be performed in that they automatically increase the counterforce when the speed of movement lies above a predetermined limiting speed and they automatically reduce the counterforce when the speed of movement lies below a predetermined limit. In turn other devices automatically change the magnitude of the counterforce with consecutive executions of the training movement so that prespecifiable load profiles can be followed.

Consequently, in DE 195 32 254 C1 and US 850,938 dumbbells are in each case described with which an oscillation produced by unbalanced driven masses in the dumbbell is transferred to the muscles of the body part to be trained with the dumbbell.

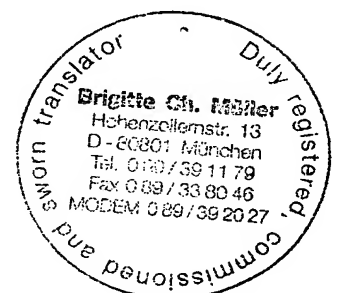
In DE 200 10 140 U1 a supplementary device for a training device is described which oscillates its actuating handles or surfaces. In this way the muscles of the individual working on the actuating handles or surfaces are subjected to load variations.

Finally, in the most closely related prior art document, US 4,989,861, a training device is described which produces a series of pulsing forces in the direction of a resistance force generated by the training device. In this manner the muscles of the individual who is training are stretched with the pulsing force. The training device comprises a pulse-force generation unit which produces the pulsing force and transfers the force via a pulling means, such as for example a chain, in the direction of the resistance force.

All these measures have the purpose of achieving a detectable training effect as fast as possible with the lowest possible risk of injury and the most simply to perform training movement.

Also the object of this invention is to further improve known training devices such that more effective training is possible with an unchanged simple movement.

According to the invention this object is solved for a retrofit kit and training device of the type mentioned in the introduction in that the oscillation generating device is formed as a single weight.



The superposition of the counterforce with the oscillations leads to an increase in the training effect, because the dynamic or static weight training with an essentially constant counterforce is linked to reflex training. The variations of the counterforce according to the invention lead to a more rapid fatigue of the muscles and to an increased training stimulation.

The special advantage of the invention lies in the configuration as a retrofit kit by which any conventional weight machines can be supplemented and their training effect improved. Apart from the training devices with guided movement, in a simple embodiment also dumbbells can be equipped with the retrofit kit.

Of course, the oscillation generating device can also be built into new training devices right from the start during production.

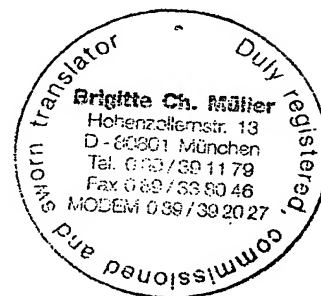
The invention relates to training devices with which the counterforce is generated by a movable training weight. The training weight comprises one or many single weights, which can be combined to one total weight. The single weights can here be formed in particular disc or plate-shaped.

In order not to interfere with the operation of the training device, the size of the retrofit kit is matched to the available space in the training device. A particularly low impairment of the operation of the training device arises, because the oscillation generating device is according to the invention designed in the form of a single weight. Moreover, the oscillation generating device can for example be accommodated in a housing, the dimensions of which correspond to a single weight or a stack of single weights. The oscillation generating device is simply used as a single weight.

The retrofit kit and the training device can be further improved by various, mutually independent designs as briefly explained in the following.

The oscillation generating device can be adapted to be attached to the training weight so that it also moves with the movement of the training weights. With training weights shaped as discs or plates the oscillation generating device can in particular be designed to be placed on the training weight. Both measures facilitate a simple conversion of the training device and an effective transfer of the oscillations into the training device.

In order to be able to set the same counterforces when using the oscillation generating device as for training without the oscillation generating device, it is advantageous if the sections of the oscillation generating device moving under the action of the training force exhibit a weight which essentially corresponds to one or



an integer multiple of a single weight. Through this measure the counterforce can be put together as usual from a number of single weights, because the oscillation generating device can be used as a single weight. Typical weights for the oscillation generating device as used as single weights in training devices are for example 0.5 kg, 1 kg, 2 kg, 5 kg, 10 kg, 20 kg and 50 kg.

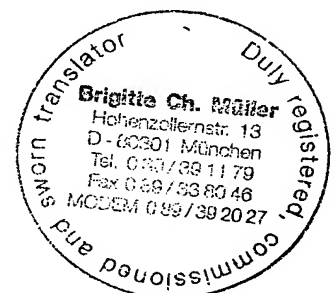
To generate the oscillation modulating the counterforce, the oscillation device can comprise a periodically moving oscillating mass and / or a vibration motor. The oscillation generating device can in this embodiment not only be used in training devices in training weights, but rather also in training devices with a counterforce produced in a different way. The oscillation generating device only needs to be fitted to an element moved by the training force and due to the inertia of the moving oscillating mass it produces an oscillating force that is superimposed on the counterforce.

The training effect can be increased in a further embodiment if the amplitude and frequency of the oscillation modulating or superimposed on the counterforce are matched to the training force and the training movement. To achieve the optimum adaptation of the oscillations to the training conditions, the retrofit kit or the training device can in a further advantageous embodiment comprise a control device which allows the oscillation amplitude and / or oscillation frequency generated by the oscillation device to be changed. For example, when training with a higher counterforce and a slower movement speed, a slow oscillation of high amplitude and when training with a low counterforce, a high frequency oscillation of low amplitude can be superposed to the counterforce.

Hereby, the control device can be advantageously arranged in a housing remote from the oscillation generating device, so that a comfortable remote control, for example from the training site, is possible.

In an advantageous embodiment, which irrespective of the previously discussed versions can represent an independent invention, the oscillation generating device is configured in the form of a dumbbell or in the form of a dumbbell weight.

Here, the dumbbell or the dumbbell disc can be provided with contacts and a rechargeable energy supply device, which is automatically rechargeable via the contacts on depositing the dumbbell in a receptacle provided for this purpose. The dumbbell or the dumbbell weight can be brought to a standard weight such as for example 5 kg by additional supplementary weights. In an advantageous embodiment the vibration motor can be arranged as centrally as possible in the handle of the dumbbell disc and drive appropriate flywheel masses at the ends. This measure produces an ergonomically balanced dumbbell. Alternatively, vibrating motors with appropriate flywheel masses can be used spaced essentially equally from the centre of the dumbbell. Also in this case the dumbbell is balanced.



In the following, various embodiments of the invention are explained as examples with reference to the drawings. As emerges from the above description of the individual advantages of the various versions, the various embodiments different features can be combined with one another as required and individual features also omitted in the individual embodiments.

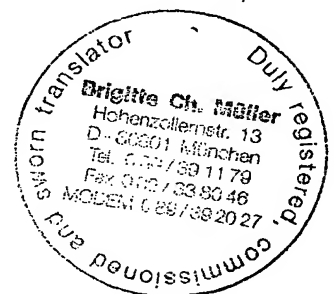
The following are shown:

- Fig. 1 a schematic perspective view of a training device with a first embodiment of the oscillation generating device according to the invention;
- Fig. 2 a schematic representation of the time trace of the force in a training device with an oscillation generating device according to the invention;
- Fig. 3 a schematic perspective view of a second embodiment of an oscillation generating device;
- Fig. 4 a schematic perspective view of a further embodiment of a training device according to the invention;
- Fig. 5 a schematic perspective view of a further embodiment of a training device according to the invention in the form of a dumbbell;
- Fig. 6 a schematic perspective view of a further embodiment of a training device according to the invention in the form of a dumbbell weight.

Fig. 1 shows a schematic view of an embodiment of a training device 1, which comprises a force generating device 2 and an oscillation generating device 3, for example in the form of a retrospectively fitted retrofit kit.

The training device 1 also exhibits an actuating element 4 via which a user, not illustrated in Fig. 1, applies a training force  $T$  to the training device 1. The actuating element 4 can, as shown in Fig. 1, be configured in the form of an interchangeable handle bar, so that by pulling on the handle bar with the training force  $T$  the muscles in the arm/shoulder region are trained. With other embodiments of the training device 1 the actuating element 4 can be configured in the form of pressure elements, which can be pressed away under the action of the training force  $T$ .

The training force  $T$  is passed from the actuating element 4 via a force transfer element 5 to the force



producing means 2. The force transfer element 5 can, as shown in Fig. 1 as an example, be configured as a traction means guided, for example, by pulleys 6.

When the training device 1 is operated, the force producing means 2 produces a counterforce  $G$  acting against the training force  $T$ , so that the movement of the actuating element 4 encounters a resistance which leads to the training effect.

As exemplarily shown in Fig. 1, the force producing means 2 for generating the counterforce  $G$  can comprise a training weight 7, which is connected to the force transfer element 5 and is moved by pulling on the actuating element 4. With this embodiment the level of the counterforce  $G$  depends on the total weight of the moving mass of the training weight 7.

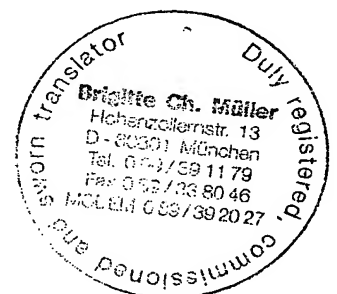
To train with different counterforces  $G$  the at least one training weight 7 can comprise a number of single weights 8 which can be combined to form a training weight of a specified mass. The single weights 8 preferably exhibit standardised masses such as for example 0.5 kg, 1 kg, 2 kg, 5 kg or 10 kg. The single weights can be accommodated interchangeably in the training device.

The single weights 8 are designed disc or plate-shaped and are arranged in the form of a stack. The level of the counterforce  $G$  is thus determined in a simple manner according to the weight of the stack of single weights moved by the training force  $T$ .

As can also be seen in Fig. 1, the training weight 7 in the training device 1 is guided by rod-shaped guide elements 9 in a shaft-like receptacle so that the risk of injury due to uncontrolled movements of the training weight is minimised.

Due to the oscillation generating device 3 fitted to the training device 1, the training effect of the training device 1 is increased. The oscillation generating device 3 produces an oscillation with which the counterforce  $G$  is superimposed and modulated. The modulation of the counterforce  $G$  due to the oscillation is schematically illustrated in Fig. 2.

In Fig. 2 the trace of the counterforce  $G$  against time  $t$  is plotted with the oscillation generating device 3 switched on. As can be seen, the momentary value  $G$  of the counterforce is composed of a temporal mean  $\underline{G}$  and a momentary oscillatory component  $G'$ :  $G = \underline{G} + G'$ . The temporal mean  $\underline{G}$  corresponds to the force produced by the force generating device 2 and the oscillatory component  $G'$  can be attributed to the oscillation generating device 3.



As can be seen in Fig. 2, the oscillatory component  $G'$  can exhibit in particular a sinusoidal trace with a periodicity  $T$  or a frequency  $f = 1/T$  and an amplitude  $G_A$ , so that  $G' = G_A \sin 2\pi f t$  applies.

The counterforce with the oscillations is transferred via the force transfer element 5 to the actuating element 4 so that the user is also subjected to the dynamic variations of the counterforce: If the training individual pulls with a constant training force  $T$ , then the difference  $T-G$  changes with the varying force  $G'$ . The force difference leads to a varying movement superimposed on the training movement, causing the additional training stimulation.

The frequency  $f$  and the amplitude  $G'$  of the varying force produced by the oscillation generating device 3 can be set independently of one another via a control device 10 and optimally matched to the training force  $T$ .

Thus, it is recommended for example that when training with a high counterforce  $G$  and a rather slow execution of the training movement, a low frequency  $f$  and a high amplitude  $G_A$  is set.

The control device 10 is arranged in a separate housing and connected via a signal lead 10a to the oscillation generating device 3, so that the change of the amplitude and / or frequency can occur ergonomically favourable at a position remote from the training weight.

Fig. 3 shows a further embodiment of an oscillation generating device 3 according to the invention. The oscillation generating device 3 of Fig. 3 is configured in the form of a single weight 8. The weight of the sections of the oscillation generating device 3 that are moved under the action of the training force is set such that it corresponds to one single weight 8 or an integer multiple of the single weights 8. For example, the single weights 8 can in each case exhibit a mass of 0.5 kg and the oscillation generating device 3 can exhibit a mass of 1 kg. In this way familiar counterforces  $G$  can be combined from the single weights also when using the oscillation generating device 3.

In the configuration as a single weight the oscillation generating device 3 is preferably arranged instead of that single weight in the stack with which, when the training device 1 is operated, the lowest counterforce is set, for example instead of the topmost single weight in the embodiment of Fig. 1.

With this configuration the oscillation generating device 3 is arranged in the form of a single weight which can be connected on one side to the force transfer element 5, so that the force flux of the training force  $T$  and the counterforce  $G$  is directed through the oscillation generating device.



Also, the oscillation generating device 3 can be provided with a rod 11 which extends through the stack of single weights 8. At openings 12 of the rod 11 a stack of single weights 8 can be suspended on the rod 11 in that a pin 13 is inserted through an opening 14 in the single weights which is flush with the openings 11. By inserting the pin 8 in the opening 14 and the opening 12 located behind it, the respective single weight 8 is suspended on the rod 11 and carries the stack of single weights located above it.

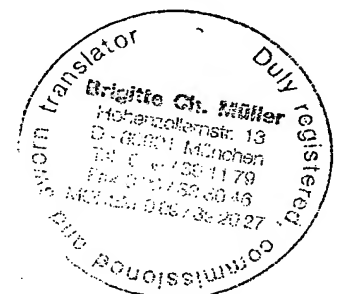
The oscillation  $G'$  superimposed on the counterforce  $G$  can be produced in the oscillation generating device 3 for example by a moving oscillating mass 15. Due to a to and fro movement of the oscillating mass 15, such as a pendulum movement or an eccentric rotary movement, a time-varying force is produced in the direction of the training force  $T$  due to the inertia of the oscillating mass 15. With the embodiment of Fig. 3 the oscillating force is produced by an eccentric unbalanced mass 15 which is driven by an electric rotary motor 16 and which has its centre of gravity offset from the axis of rotation 17 of the rotary motor.

The frequency of the varying force  $G'$  is defined by the speed of the rotary motor 14. The amplitude of the weight force  $G'$  can be changed by the eccentricity of the unbalanced weight 15, i.e. by a change in the distance of the centre of gravity of the eccentric mass 15 to the axis of rotation 17. The larger the eccentricity of the unbalanced weight, the larger the amplitude  $G_A$  of the oscillations produced by the oscillation generating device 3. The power supply for the rotary motor 14 can be provided via the control lead 10a and the control device 10.

The embodiment as it is described in Figs. 1 and 3 can be used not only with a training device with training weights, but rather also with training devices which produce the counterforce in a different way. The oscillating force produced by the oscillation device actually modulates the counterforce independently of how the counterforce is produced. For example, the oscillation generating device 3 can introduce the oscillations directly on the actuating element 4, as is illustrated as an example in Fig. 4 with a training device formed as a leg press with a pneumatic pressure cylinder as the force generating device 2. To achieve an introduction of the oscillations into the training device as free of losses as possible and with the most direct superimposition of the counterforce  $G$  as possible, it is advantageous if the oscillation generating device is fitted directly to the parts moved by the training force or directly on the parts bearing the training force.

In Fig. 5 a further embodiment of the training device in the form of a dumbbell 1 is illustrated. The use of the oscillation generating device with dumbbells can represent an invention of its own irrespective of the use of the oscillation generating device with more complex, movement-guided training devices, such as they are described in Figs. 1 to 4.

As illustrated in Fig. 5, the dumbbell 1 is also realised as an oscillation generating device 3. The dumbbell 1



comprises a grip section 18 and at the ends of the grip section 18 two fixed or removable weight sections 19, the diameter of which is larger than the diameter of the grip section 18. The masses of the weight sections 19 correspond so that the dumbbell 1 is balanced overall.

The dumbbell 1 is provided with a vibrating motor 14, which drives two unbalanced weights 16 in each of the weight sections 19 about the axis of rotation 17. The axis of rotation 17 extends essentially in the direction of the grip section 18. Furthermore, in the weight sections 19 energy supply devices, such as for example non-rechargeable or rechargeable batteries, can be arranged for the drive (not shown) of the vibrating motor 14, which are accessible via a removable housing section 20 on the dumbbell 1. In order to, for example, charge rechargeable batteries for the operation of the vibrating motor 14 without having to dismantle the dumbbell, contacts 21 can also be provided via which the dumbbell is automatically charged in an appropriate dumbbell receptacle.

For the weight of the dumbbell 1 to correspond to a standard weight, additional weights 22 can be provided in the weight sections 19 of the dumbbell 1, which can be complemented with the vibrating motor 14, dumbbell housing 1, energy supply devices and the flywheel masses 16 for the standard weight.

To fit the dumbbell easily into the hand, the unbalanced masses 16, which are arranged on a continuous drive shaft 23 of the vibrating motor, are equally large. Of course two vibration motors which drive the unbalanced masses 16 independently of one another can also be provided instead of a single vibration motor 14.

In Fig. 6 a further embodiment of a single weight formed as an oscillation generating device 3 is shown. The single weight of the embodiment of Fig. 6 is formed as a dumbbell disc in which a vibrating motor 14 is integrated, which moves the flywheel masses 16 to and fro in the direction of the arrow 25 via a crank mechanism 24. Moreover, the flywheel mass 16 is moved in guides 26. With the embodiment of Fig. 6 instead of a crank mechanism an eccentric ring can be provided which runs around the dumbbell rod receptacle 27 of the dumbbell disc with an unbalanced weight.

During training, the single weight of Fig. 6 with the opening 27 is simply pushed onto the dumbbell rod, preferably in pairs, on both ends of the dumbbell rod.

